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DEPARTMENT OF AGRICULTURE.
TERRITORY OF NEW GUINEA.

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TERRITORY OF NEW GUINEA.

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FOREWORD.

After the reception accorded the first issue, we feel that we have embarked on a scheme that will fill a decidedly useful purpose for the Territory. Any contributions making suggestions or describing methods of general interest for discussion will be appreciated.

The recent upward rise in copra has been most welcome, but it is to be regretted that the trend in general quality in that product has taken a downward turn in many cases. Every care should be taken to improve the general quality, and the observations recorded in the article on "Copra Drying" should help materially in this connexion.

The article on approximate periods of flowering of ornamental trees as observed in the Botanic Gardens, will assist in answering queries often raised for flowers and seeds, and with the succeeding articles will form a very useful record on these questions.

"Cocoa Fermentation", giving results of experiments carried out in this Territory should be of valuable assistance to cocoa planters and prospective planters in this intricate problem.

"Entomological Notes" records observations on some of the important pests of economic crops in this Territory.

"Meteorology" has been enlarged in this issue, and further data will be given from time to time, indicating the relation of rainfall to time of year in different districts. Such records will ultimately enable us to determine zones for various crops.

The question of submission of specimens and data in relation to pest or disease occurrence is most essential if a proper understanding of the position is to be gained, and is more especially necessary in this Territory where transport is sparse and in some parts uncertain if delays are to be avoided in getting information back to enable control of the pest or disease in question.

"Warts on Cattle" refers to a not uncommon trouble with cattle and outlines precautions that should be taken to prevent it spreading to others of the same herd.

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RECENT EXPERIMENTS IN THE CURING OF NEW GUINEA CACAO.

By E. C. D. Green, H.D.A., A.I.C.T.A.

In a recent publication,* a broad description of the curing of cacao was outlined, based on observations made by the writer whilst in Trinidad, and was intended to act as a guide to planters in the Territory, until such time as curing experiments could be carried out in this Territory.

Through the courtesy of Mr. H. J. Washington, Kabaira Plantation, and Mr. W. R. Huntley, Vunakambi Plantation, it was possible to commence a series of fermentation and drying experiments.

Although the experiments are not yet complete, it is considered that the data available at present should be published, and are therefore embodied in this paper.

Fermentation.

Twelve experiments were conducted, the beans being fermented at varying depths, and for different periods.

One type of box, the "Vunakambi", was used for the first four experiments, and later, another type, the "Kabaira" was introduced, and the two types were used throughout the remaining eight experiments.

The "Kabaira" box measured 4′ x 3′ 10″ x 2′ and drainage holes $\frac{3}{8}$″ diameter were spaced at random in the floor. The "Vunakambi" box measured 5′ 5″ x 2′ 11″ x 1′ 9″, and had drainage holes in the floor $\frac{3}{8}$″—$\frac{1}{2}$″ diameter, spaced 3″—3$\frac{1}{2}$″ apart. Both types were constructed with sawn timber one inch in thickness.

The boxes were placed nine inches above ground level; in a large barn made of bush materials (limbom sides, sac-sac roof) with earth floor, a large opening in front, and two windows in each side.

Each box was scraped and thoroughly cleaned before receiving the beans, and no metal was allowed to come into contact with the mass during fermentation.

The beans were changed from one box to another every forty-eight hours, particular care being taken to ensure that the beans from the sides went into the centre, those from the top and bottom to the centre, and those from the centre to the sides, top, and bottom. A wooden "spatula", made by affixing the top of a "kerosene" case to a handle, was used for changing.

* E. C. D. Green.—"The possibility of developing an economic cacao industry in the Mandated Territory of New Guinea after a study of the industry in Trinidad, and a suggested policy for that development." *Bulletin*, No. 2, Department of Agriculture, T.N.G.

In all experiments the mass was covered with banana leaves, which were renewed after each "turning".

During fermentation, average temperatures were recorded in the centre, and at the sides of the mass, every twenty-four hours, also prior to and immediately after "turning".

The following table (No. 1) shows the box dimensions, depth of beans and period of fermentation, in respect to each experiment.

TABLE No. 1.

Experiment No.	Box Dimensions.	Depth of Beans.	Period of Fermentation.
			Hours.
1	5′ 5″ x 2′ 11″ x 1′ 9″	8″	120
2	5′ 5″ x 2′ 11″ x 1′ 9″	8″	144
3	5′ 5″ x 2′ 11″ x 1′ 9″	12″	120
4	5′ 5″ x 2′ 11″ x 1′ 9″	12″	144
5	5′ 5″ x 2′ 11″ x 1′ 9″	21″	144
6	4′ 0″ x 3′ 10″ x 2′ 0″	21″	144
7	5′ 5″ x 2′ 11″ x 1′ 9″	12″	156
8	4′ 0″ x 3′ 10″ x 2′ 0″	12″	156
9	5′ 5″ x 2′ 11″ x 1′ 9″	21″	156
10	4′ 0″ x 3′ 10″ x 1′ 9″	21″	156
11	5′ 5″ x 2′ 11″ x 1′ 9″	12″	162
12	4′ 0″ x 3′ 10″ x 2′ 0″	12″	162

In tables Nos. 2 and 3, the temperatures, recorded in each experiment every twenty-four hours, and the average temperatures during fermentation, are set out in degrees Fahrenheit.

In experiments Nos. 1, 3, 5, 6, 7, 8, representative samples of beans, taken from the centre, sides top and bottom of the mass were removed for drying, and fermentation of the remaining beans allowed to proceed.

Observations During Fermentation.

During the period of fermentation, observations were recorded every twenty-four hours in respect to appearance and colour changes in the beans and pulp.

In all instances the pulp was whitish when fermentation commenced, and at the expiration of the first twenty-four hours very little change in colour had occurred.

At the end of forty-eight hours the pulp was a very light brown, and the interior of the beans was dry and close textured.

After seventy-two hours the pulp had changed to light brown, a certain amount of bean swelling had taken place, and in experiments Nos. 5, 6, 9, 10, the interior of the bean was moist. There was a slight reduction in the original internal violet to purple colour, a reddish tinge being noticed, and the cotyledons had commenced to separate.

At ninety-six hours the pulp was a rich light brown colour, beans were very swollen. In experiments Nos. 5, 6, 9, 10, the beans were filled with a very light brown liquid, reddish tinge was pronounced, and separation of the cotyledons noticeable. In experiments 1, 2, 3, 4, 7, 8, 11, 12, the internal condition of the bean was similar to that at seventy-two hours in experiments Nos. 5, 6, 9, 10.

TABLE No. 2 (Centre of Mass).

Experiment No.	Hours.												
	0.	24.	48.	48.*	72.	96.	96.*	120.	144.	144.*	156.	162.	Average.
1	78	98	105.5	98.5	110	108	101	108	..	..	..	..	105.9
2	78	98	105.5	98.5	110	108	101	108	95	..	..	..	104.1
3	78	94	101	90	120	111	103	120	..	..	..	..	109.2
4	78	94	101	90	120	111	103	120	102	..	..	..	108
5	78	107.5	110	97	119	120	111	115	110	..	..	..	113.6
6	78	106	113	97	120	120	110	112	108	..	..	..	113.2
7	78	105	107	96	111.5	110	101	112	102	98	110	..	108.2
8	78	98	109	101	118	109.5	105	113	107	100	112	..	109.5
9	78	107.5	110	97	119	120	111	115	110	104	114	..	112.2
10	78	106	113	97	120	120	110	112	108	103	112	..	113
11	78	105	107	96	111.5	110	101	112	102	98	110	116	109.2
12	78	98	109	101	118	109.5	105	113	107	100	112	113	109.9

TABLE No. 3 (Sides of Mass).

Experiment No.	Hours.												
	0.	24.	48.	48.*	72.	96.	96.*	120.	144.	144.*	156.	162.	Average.
1	78	97	105	92.5	106	105	100	102	..	..	..	..	103
2	78	97	105	92.5	106	105	100	102	92	..	..	..	101.2
3	78	97	97.5	90	112	105.5	102	115	..	..	..	..	105.4
4	78	97	97.5	90	112	105.5	102	115	100	..	..	..	104.5
5	78	109	105	96	108	118	107	109	107	..	..	..	109.3
6	78	102	106	96	107.5	117	109	104	104	..	..	..	106.8
7	78	105	104	94	105	107	100.5	105	99	95	103	..	103
8	78	98	105	101	114	103.5	102	107	98	97	106	..	105.3
9	78	109	105	96	108	118	107	109	107	103	109	..	109.3
10	78	102	106	96	107.5	117	109	104	104	101	105	..	106.4
11	78	105	104	94	105	107	100.5	105	99	95	103	107	103.5
12	78	98	105	101	114	103.5	102	107	98	97	106	110	105.9

* Denotes after changing.

At one hundred and twenty hours the drying of experiments Nos. 1 and 3 was commenced, the pulp was a rich brown colour, beans were swollen, contained a small amount of light brown liquid, cotyledons were slightly separated, and the skin of the bean was taut. The beans in experiments Nos. 5, 6, 9, 10, contained a large amount of liquid which was slightly darker in colour than at ninety-six hours, the internal purplish colour had become a purplish-red to red, and the cotyledons were apart. The beans in the other experiments were similar to those in experiments Nos. 1 and 3.

After one hundred and forty-four hours the beans in experiments Nos. 2, 4, 5, 6, were removed for drying. Those in experiment No. 2 were mouldy, adhering to each other, pulp was a dark brown to black, and there was a musty aroma. In experiments Nos. 4, 5, 6, no mould was present, the beans were swollen, a large amount of pulp was adhering, purplish colour still pronounced, liquid slightly darker in colour.

At one hundred and fifty-six hours, when the beans from experiments Nos. 7, 8, 9, 10, were taken out to dry, those at a depth of 12″ showed the same rich brown pulp colour as those at 21″, but the liquid was a lighter brown, the cotyledons were not separated so much, and the purplish-red tinge was still present. The beans at 21″ showed a reddish-purple internal colour, and the liquid was dark cinnamon to chocolate in colour.

After a hundred and sixty-two hours, when the beans from experiments Nos. 11 and 12 were removed for drying, the pulp colour was a rich brown, liquid being still a lightish colour; internally the beans were red to reddish-purple, and the cotyledons were well apart.

Loss in Weight Due to Fermentation.

Two experiments were conducted to ascertain the loss in weight during fermentation. The periods of fermentation were 156 hours and 162 hours, the depth of beans in experiment No. 9 (Table No. 1) was 21″, and in experiment No. 11 (Table No. 1) 12″, the "Vunakambi" type of box was used in both instances.

The following table No. 4 sets out the results obtained:—

TABLE No. 4.

Experiment No.	Original Weight Beans in Box.	Weight to Dry.	Loss in lb.	Per cent. loss.
	lb.	lb.		
9	1,036	876	160	15.44
11	681	583	98	14.39

Drying.

An improvised drying platform which could be covered with a tarpaulin, was constructed at the Government Demonstration Plantation, Keravat. All the beans fermented in experiments Nos. 9 and 11 were dried by the writer, but only representative samples were taken from the other experiments, the remainder of the beans being despatchd to Kabaira and Vunakambi Plantations.

The period allowed for drying was seven days, and this period was found to be sufficient.

During the first day of drying the beans were spread at a depth of two inches, and during the second, third and fourth days the depth was increased to three inches.

On the morning of the fifth day the beans were heaped and "danced", imparting a polish and removing the slight mould that had appeared on the fourth day. After "dancing", the beans were spread to a depth of 2" until noon, after which the depth was increased to 3".

During the sixth and seventh days, the beans were four inches deep.

Throughout the whole period of drying the beans were constantly turned, but not heaped during the night.

Table No. 5 shows the hours of sunlight and the times at which rain fell during the seven days of drying.

TABLE No. 5.

Day of Drying.	Hour placed to Dry.	Hour when Rain Commenced.	Period of Sun.	Remarks.
	a.m.	p.m.	hrs.	
1st	6	2	8	
2nd	7	2.30	7½	Light rain to 6.30 a.m.
3rd	7.30	1.30	6	Light rain to 7 a.m.
4th	6.30	1.45	7¼	Slight mould showing
5th	7	4	9	Beans "danced"
6th	6.30	..	10½	
7th	6.30	..	10½	Drying completed

At the expiration of drying, the percentage of under-fermented beans was calculated, observations were made in respect to the pulp and beans, and the loss of weight ascertained.

Table No. 6 shows the amount of under-fermented beans, and in Table No. 7 is set out the loss in weight during drying, and total loss in fermentation and drying.

TABLE No. 6.

Experiment No.	Per cent. Under-fermented.	Observations.
1 ..	14.68	Beans were very hard, number had germinated, those under-fermented were cheesy, purplish, astringent. Beans had a good external colour
2 ..	13.29	Beans were hard, number had germinated, those under-fermented were cheesy, purplish, astringent. Sample was a very bad colour externally
3 ..	10.72	Beans were hard, close textured, those under-fermented were astringent and purplish
4 ..	6.53	Big percentage of beans were hard when dry, good external colour
5 ..	2.19	Very few hard beans, no totally cheesy beans, good external colour, very little pulp
6 ..	2.22	Similar to Experiment No. 5
7 ..	1.47	Not much pulp, few hard beans, good external colour, no totally cheesy beans, slight purple tinge in the under-fermented beans, very slight astringency
8 ..	1.65	Similar to Experiment No. 7
9 ..	.92	Beans broke cleanly, good aroma, external colour good
10 ..	.94	Similar to Experiment No. 9
11 ..	1.08	Improvement on Experiments Nos. 7, 8, beans had a clean break, internal colour chocolate brown, slight astringency noticeable, aroma good
12 ..	1.14	Similar to Experiment No. 11

TABLE No. 7.

Experiment No.	Weight Beans to Dry.	Weight Dry Beans.	Loss in lb.	Per cent. Loss.	Total per cent. Loss Ferment, Drying.
9	876	477	399	47.83	63.27
11	583	318	265	45.45	59.84

Discussion.

Reference to Tables Nos. 2, 3, shows that when the cacao was fermented at a depth of 8″, the average temperature recorded at the centre and sides of the mass was much lower than at 12″ and 21″; also at a depth of 12″, the temperatures were lower than at 21″.

The difference in temperature between that at 8″ and 12″, was approximately the same as between 12″ and 21″.

Experiments Nos. 1, 2, indicate that a fermentation period of 120-144 hours, at a depth of 8″ in the type of box used is insufficient, and, as shown by Experiment No. 2, when the average temperature at the end of 144 hours was less than that at 120 hours, the beans were black, mouldy, and had an offensive smell.

With the depth of beans at 12″, and an average temperature in the centre and sides of 109.2 and 105.4 degrees respectively, and the fermentation period 120 hours (Experiment No. 3), the percentage of under-fermented beans was high, but the colour and smell was good, and mould was not evident. When the period was extended to 144 hours (Experiment No. 4), and an average temperature of 108 and 104.5 degrees respectively at the centre and sides was obtained the external colour of the pulp and beans was still good, no mould was present, although the percentage of under-fermented beans was still high.

In Experiments Nos. 7, 8, when the fermentation period was extended to 156 hours, the average temperature at the centre and sides was 108.2–109.5, and 103-105.3 degrees respectively. The beans were not mouldy, the external appearance was good, and the amount of under-fermented beans had been reduced to 1.47-1.65%.

When fermentation proceeded for another six hours (162 hours, Experiments 11-12), the average temperature at the centre and sides was still maintained, no mould appeared, the external colour was good, and the amount of under-fermented beans had dropped to 1.08–1.14%.

At a bean depth of 21″, a fermentation period of 144 hours (Experiments 5, 6), and average temperatures at the centre and sides of 113.2–113.6, and 106.8–109.3 degrees respectively, no mould was present, external colour was good, and the under-fermented beans amounted to 2.19–2.22%, compared with 13.29% at 8″, and 6.53% at 12″.

When the beans at 21″ depth were fermented for 156 hours, (Experiments 9, 10), with an average temperature at the centre and sides of 112.2–113.0, and 106.4–109.3 degrees respectively, no mould was present, the external bean colour showing at 144 hours had been maintained, and the amount of under-fermented beans was reduced to .92–.94%.

The data obtained up to the present, indicate that the average temperature, which appears to be correlated with the depth of beans relative to the dimensions of the box, is an important factor in fermentation. With a large box and a small amount of beans, the average temperatures obtained were low, and the percentage of under-fermented beans high, compared with the higher temperatures and larger quantities of beans.

Furthermore, after a period of 144 hours (Experiment No. 2), when a reduction in temperature of 13 degrees in the centre, and 10 degrees at the sides had occurred, thereby reducing the average temperature, the beans developed a bad external colour, an unpleasant odour, and mould.

At a depth of 12″ in the two types of boxes used, it appears that either a longer period than 162 hours will have to be adopted, or the beans heaped during the first and second nights of drying.

In both types of boxes the depth of 21″ gives good results, and if the beans were to be heaped during the first night of drying, the percentage of under-fermented beans would be further reduced.

Some modification is required if small amounts of beans are to be fermented successfully, and experimentation along the lines advised by Briton-Jones* is worthy of trial.

That a loss in weight does occur during fermentation and drying, has been proved on many occasions,[1], [2], [3], [4] and the figures obtained with New Guinea cacao are commensurate with those obtained elsewhere.

Summary and Conclusions.

Boxes of different dimensions were used, and varying depths of beans were fermented for different periods.

The greater the depth of beans, the higher were the average temperatures recorded.

A fermentation period of 120 and 144 hours, at a depth of 8″–12″ was not successful with the type of box used.

At 156 and 162 hours, fermentation was successful at a depth of 21″ and 12″ respectively, but a slight alteration in the method of drying appears necessary.

Further experimentation in curing is required, particularly for small quantities of beans.

The loss of weight which occurred during curing, is comparable with that in other countries.

Acknowledgments.

The writer desires to acknowledge his appreciation of the assistance given by Messrs H. J. Washington and W. R. Huntley, who, by providing boxes and material made it possible for the experiments to be conducted.

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* H. R. Briton-Jones, *The Diseases and Curing of Cacao*, pp. 135, 136, 137.

(1) De Verteuil, J., *Preparation of Cacao for Market*. Department of Agriculture, Trinidad and Tobago, 1933.

(2) Hart, J. H., *Cacao, its Cultivation and Curing*, 1911.

(3) Johnson, W. H., *Cocoa, its Cultivation and Preparation*, 1912.

(4) Van Hall, C. J. J., *Cacao*, 2nd Edition, 1932.

ENTOMOLOGICAL NOTES.

By John L. Froggatt, B.Sc., Entomologist.

COCO-NUT PESTS.

In the Mandated Territory of New Guinea, foliage pests of the coco-nuts are of greater economic importance than all the other pests combined. In the previous issue of this *Gazette* the depredations of the Coco-nut Leaf Hopper (*Sexava spp.*) and also the research work on the problem of this pest were discussed.

The next in importance of the coco-nut foliage pests are the two beetles *Promecotheca antiqua,* Wse., and *Brontispa froggatti,* Sharp., belonging to the family *Hispidæ,* a group of the *Chrysomelidæ.*

Plesispa ruficollis, Speeth., and *Oxycephala papuana,* Gerst., have been collected in numbers (in the Manus District only, to date) both by themselves and in association with *B. froggatti,* and causing similar damage.

Oxycephala cornigera, Guer., has been collected in the opening spear of young coco-nuts but is comparatively rare, and its importance as an economic species has not yet been determined.

Promecotheca antiqua.

This pest is fairly generally distributed throughout the Territory, but is very much worse in some areas than in others. Where this insect is present in large numbers it causes severe setback to the palms and leads to serious falling off in production.

The damage to the foliage is of a twofold nature. Firstly, the beetles feed in parallel lines along the undersurface of the leaflets eating off the surface tissue, thus leading to a shrivelling of the attacked pinnæ. Secondly, the larvæ mine in between the two layers of the leaf causing such to separate and thus die, a considerable area of leaf surface being rendered useless for the development of plant foods vital to the wellbeing of the palms. The combined effect turns the foliage brown, and palms badly attacked present the appearance of having had the fronds badly singed.

Life History and Habits.

The eggs are laid in a cluster, usually two or three together (sometimes as many as five) on the undersurface of the pinnæ, and covered with frass cemented with excretory fluids from the female. The egg-mass measures 3–4 mm. in diameter.

Under insectary conditions the egg stage has lasted 11–17 days (av. 14 days). The larvæ on emerging immediately burrow in between the two layers of the leaf and keep feeding away from the site of entrance, the area attacked on the feeding-face gradually increasing as the larvæ develop.

The larva is a dull white in colour with head reddish brown. The larval period occupies from 17–23 days (av. 21 days) under insectary conditions.

When the larvæ are full-fed they retreat from the "feeding-face" and retire into the previously mined tissue, where a short pre-pupal stage is passed through before the transformation to the pupa takes place: owing to difficulties in observation the pre-pupal period has not been determined, the larvæ dying when removed from the leaf tissue, which is in itself too opaque to permit a view of the larvæ.

Pre-pupal and pupal periods combined average 14 days, but the adult on emerging, apparently does not emerge on to the surface for at least several hours. The complete life-cycle is thus 42–54 days (av. 49 days). As there is apparently no material seasonal variation in the development of this pest, it is probable that there are about seven generations in the year.

The adults measure 8–10 mm. in length and about 5 mm. in width. The head, thorax and anal two-thirds of the elytra (wing covers) are dark purple in colour, while the anterior portion of the elytra varies from orange to yellow in colour.

The life of the adults is apparently a fairly long one, the beetles in the insectaries having lived on small palms for at least six weeks.

Control.

Spraying would probably control this pest, but in order to deliver the spray on to the foliage of most palms a power sprayer would be required, and the cost of insecticides and plant would be prohibitive from an economic point of view.

Dusting of the palms with insecticides would also be costly, even from the ground, as a power plant would be required here, as for spraying.

The use of aeroplanes has often been raised in this connexion but as most of the fronds tend to hang downwards, and the beetles feed on the undersurface of the pinnæ, dusts from the air are not likely to reach effectively those parts of the foliage where the pest is feeding. Moreover, the relatively isolated nature of most plantations has to be considered, necessitating a considerable amount of manœuvering and turning, and thus waste of time and fuel. In addition the cost of the aeroplane, pilot's salary and amount of insecticide wastage, all tend to rule out such a method of application of insecticides. From an economic point of view this means of attack is not practicable in this Territory.

If, in the early stages of a severe attack by this pest, infested fronds are cut off and burnt and all beetles coming down with the fronds collected and destroyed, a very material check of the infestation will be obtained. The loss of foliage is inevitable if the pest is allowed to increase normally, and in addition the pest population would be automatically increased by leaving the infested fronds for the larvæ to develop in, and the subsequent generation, greatly augmented in numbers, would carry the infestation farther afield.

Parasites.

Parasites of both egg and larva have been bred out in the laboratory from material collected in the field, but as a rule they do not appear to exercise any material control of the pest until a considerable amount of damage has been caused.

The egg parasite has been identified by the Imperial Institute of Entomology as *Anastatus sp.* (fam. *Eupelmidæ*). The larval parasite is a species of the genus *Entedon* (fam. *Eulophidæ*).

Brontispa froggatti.

This small Hispid has a distribution from the Phillipine Islands to the Solomon Islands. In this Territory it is generally distributed and mostly occurs on young palms up to about three years old. It has, however, been found in palms of thirteen years and more, but in these cases it does not appear to cause the severe setback that it does to the young palms. The most common native host plant is the Areca palm.

Damage is caused by erosion of the surface tissue of the opening leaflets by both the larvæ and the adults, giving rise to dead areas (often of considerable size) on the young pinnæ, leading to loss of foliage surface for developing plant foods.

The adult is a slender beetle measuring up to 9 mm. in length and 1.5 to 2 mm. in width. Head and antennæ black with the thorax and anterior quarter of the elytra (wing covers) yellow to orange: the remainder of the elytra black except for the basal tip which is orange: legs and undersurface of the body yellowish brown: elytra finely striated and punctate.

The eggs are laid in between the opening leaflets of the new frond (spear). The larvæ emerge in about four days and spend their cycle in between the pinnæ eating off the surface tissue. They reach maturity in about 22–29 days, when the transformation to the pupa takes place. This stage is capable of movement and can transport itself within the area between the pinnæ: the pupa matures in about six days.

Young palms in the nursery or during the first three years of growth may receive a very severe setback from this pest, especially when the attack is severe.

In the nurseries, more especially, regular attention to collection and treatment with tobacco wash will keep the pest in control.

Plesispa ruficollis.

At a casual glance this species appears to be an overgrown specimen of *Brontispa froggatti*. The adult measures about 12 mm. in length and 3 mm. in width, with the head and thorax red, eyes black. The elytra are black with a fine margin red and are finely punctate.

Oxycephala papuana.

This very closely resembles the former species.

Oxycephala cornigera.

This beetle measures 12 mm. in length and about 3.5 mm. in width, with the head and thorax yellow. The basal half and median third of elytra are black, the remainder yellow.

Oxycephala wallacei.

This is often a serious pest of Pandanus foliage and has also been found occasionally on the fronds of mature coco-nut palms.

The adults in colouration are very similar to those of *Promecotheca antiqua* but are longer, measuring 13 mm. long and 4 mm. in width. The head, thorax and terminal third of the elytra are purple black, while the anterior two-thirds of the elytra vary from yellow to orange.

This is not a general pest of coco-nuts in so far as our information goes to date.

Lepidoptera.

The "Skipper butterfly", *Telicota bambusæ* (fam. *Hesperidæ*) is often a serious pest of the foliage of coco-nut palms, usually only up to about 1½ years old, but it has on occasion been observed causing serious defoliation to palms of 3–4 years of age.

The caterpillars are bluish grey in colour with a relatively large flat head: they join two leaflets together with silken thread and during the day remain in this shelter, coming out to feed at night.

The adult varies considerably in colour from a general dull brown with orange brown markings to a general orange brown with dark brown markings. It measures about 3.75 mm. across the outspread wings. Two parasites have been bred from the pupæ:—

Brachymeria euplocæ, Westw. (*Chalcididæ*).
Echthromorpha insidiator, Smith. (*Ichneumonidæ*).

Hand picking on small palms is the simplest and quickest method of control of the pest.

Caterpillars of *Prodenia litura,* F., occasionally cause a localised defoliation of young palms, but it is not a general pest of coco-nuts.

Larvæ of a small moth *Decadarchis ophiocypha,* Meyr. (fam. *Lyonetidæ*) have been found causing damage to young foliage on the opening fronds of mature palms, generally when the palms are recovering from a severe infestation by Sexava.

INSECT PESTS OF THE SWEET POTATO.

The sweet potato is extensively grown in the Territory not only as a food for native labour rations, but also by free natives for their own consumption, while as a substitute for potatoes it is consumed by many Europeans.

Pests of this crop are therefore of decided economic importance.

A pest which may be referred to as "spectacular" is *Hippotion celerio,* L. (fam. *Sphingidæ,* Hawk Moths).

The early stages of feeding of the larvæ of this species are generally not observed even when in plague form, but the voracious appetite during the last two or three days of the caterpillar stage very quickly defoliates the runners ("in a night" as is so often stated).

The young caterpillars are light green in colour and are distinguished by the presence of a "spine" standing up from the upper surface of the hind portion of the body. As they develop the colour deepens to almost black: when they reach maturity they burrow into the ground to pupæ. The larval period is at least ten days and the pupal period fifteen to eighteen days.

The adult moth measures 7 cm. (approx. 2½ inches) across the outspread wings. The forewings are brown with lighter coloured markings, and the hindwings reddish with dark markings. They only fly at night and are very swift in their movements.

Infestation by this pest is worst during the dry season, and often first comes into evidence about one month after the end of the wet season.

Dusting with Calcium Arsenate or Lead Arsenate, using a hand rotary dusting machine, has given effective control. The first treatment *must* be given *as soon as the first indications of feeding are observed*: two more dustings at about three-weekly intervals should then be sufficient. The nozzle should be kept well down in order to blow the dust *under* the foliage. Dusting will give the best results when carried out first thing in the morning while the dew is still on the foliage, thus assisting the powder to adhere more firmly to the surface.

Cylas formicarius, Fabr. (Sweet Potato Weevil.)

This is another serious pest of sweet potatoes, and is apparently widely distributed in this Territory, having been collected in Bougainville, New Ireland, New Britain and Manus, and reported from New Guinea.

The adult is a small, shiny, slender weevil or snout beetle, about 3.5 mm. in length, with the head, elytra and abdomen metallic blue-black, while the prothorax and legs are bright red.

The eggs are deposited in small cavities eaten out of both runners and tubers. The larvæ emerge in less than a week and tunnel through the stem into the tuber. Infested potatoes develop a bad smell and bitter taste, and will not keep in storage for any length of time. Pupation takes place inside the plant in both the runners and tubers, the adults eating their way on to the surface. The adults feed on the foliage and stems.

The life cycle is from 4–6 weeks in temperate climates and is probably less in the tropics.

In planting up, slips from infested areas should never be used except in cases of absolute necessity, and a very careful selection must then be made.

Old tubers and vines should be carefully cleaned up after harvesting and either burnt or buried very deeply.

A certain degree of control of this pest can be obtained by spraying with Arsenate of Lead (1 lb. to 50 gals. of water) as soon as the weevils appear in the fields, or by dusting with the same insecticide.

SOME INSECT PESTS RECORDED FROM THE MANDATED TERRITORY OF NEW GUINEA.

By John L. Froggatt, B.Sc.

The following list of insect pests from the Territory forms a record of identifications received from the Imperial Institute of Entomology, London.

The species referred to are all associated with a definite host, but other lists will be published later containing insects known to be pests elsewhere but so far not recorded in this Territory from any particular host:

	Cocos Nucifera (Coco-nuts).	
Orthoptera ..	*Tettigoniidae* ..	Sexava nubila, St.
		Sexava novae-guineae, Brancs.
	Gryllidae	Cardiodactylus novae-guineae, Haan.
Rhyncota ..	*Aleurodidae* ..	Aleurodicus destructor, Mack.
	Coccidae	Aspidiotus destructor, Sign.
		Mytilaspis sp.
	Pentatonidae ..	Axiagastus campbelli, Dist.
Lepidoptera ..	*Hesperidae* ..	Telicota bambusae, Moore.
		(*Parasites*—
		Chalcididae Brachymeria euploeae, Westn.
		Ichneumonidae Echthromorpha insidiator, Smith).
		Tirathaba rufivena, Walk.
		(*Parasites*—
		Tachinidae Carcelia kokiana, Towns.).
		Decadarchis ophiocypha, Meyr.
	Noctuidae	Prodenia litura, L.
Coleoptera ..	*Hispidae*	Promecotheca antiqua, Wse.
		Brontispa froggatti, Sharp.
		Oxycephala papuana, Gerst.
		Plesispa ruficollis, Speeth.
		Oxycephala cornigera, Guer.
	Lucanidae	Eurytrachelus egregius, Moll.
		Metopodontus bison, Ol.
		Cylommatus margaritae, Gestro.
		Cyclommatus speciosus, Boisd.
	Curculionidae ..	Rhyncophorus papuanus, Kirsch.
		Rhyncophorus schach, F.
		Sparganobasis subcruciata, Mshl.
		Rhabdocnemis obscura, Boisd.
		Diocalandra frumenti, F.
	Scarabaeidae Dynastidae	Xylotrupes gideon, L.
		Scapanes grossepunctatus, Sternb.
		Trichogomphus semmilinki, Rits.
		Papuana laevipennis, Arr.
	Cetonidae	Lomaptera batchiana, Thoms.
		Panglaphyra douboulayi, Thoms.
		Poecilophora emilia, White.

COPRA.

Coleoptera ..	*Cucujidae* ..	..	Silvanus aurinamensis, L.
	Cleridae ..	..	Necrobia rufipes, de Geer.
Lepidoptera ..	*Pyralidae* ..	..	Ephestia cautella, Wlk.

ATTACKING BOLE OF YOUNG PALMS.

Coleoptera ..	*Scarabaeidae*	*Dynastidae*	Papuana semistriata, Arr.
			Papuana laevipennis, Arr.
			Papuana hubneri, Frm.
			Papuana splendens, Frell.
			Camelonotus ritsemae, Hell.
			Oryctoderus latitarsis, Boisd.
			Oryctoderus goddefroyi, Frm.

ATTACKING CALADIUM BULBS.

Coleoptera ..	*Scarabaeidae*	*Dynastidae*	Oryctoderus nanus, Arr.

CALOCASIA SPP. (TARO).

Lepidoptera ..	*Noctuidae* ..	..	Prodenia litura, L.
	Sphingidae ..	..	Hippotion celerio, L.
			Theretra tryoni, Miskin.
Coleoptera ..	*Dynastidae*	..	Papuana laevipennis, Arr.
			Papuana armicollis, Frm.

SWEET POTATO.

Lepidoptera ..	*Sphingidae*	..	Hippotion celerio, L.
Coleoptera ..	*Coccinellidae*	..	Epilachna signatipennis, Boisd.
	Chrysomelidae	*Galleruchidae*	Monolepta basimarginata, Boisd.
			Aulocophora similis, Ol.
	Curculionidae	..	Cylas formicarius, Fabr.

ZEA MAYS (MAIZE).

	Noctuidae ..	..	Chloridea obsoleta, F.
			Pyrausta damoalis, Wlk.
			Pyrausta salentialis, Snell.

HIBISCUS ESCULENTUS (OKRA).

Lepidoptera ..	*Pyralidae* ..	..	Sylepta derogata, F.
Rhyncota ..	*Pyrrhocoridae*	..	Dysdercus variegatus, Dist.

ARACHIS HYPOGOEA (PEANUTS).

Lepidoptera ..	*Noctuidae* ..	..	Prodenia litura, L.
	Tortricidae ..	..	Homona phanaea, Meyr.
			Adoxophyes epizeucta, Meyr.

RICINUS COMMUNIS (CASTOR OIL).

Lepidoptera ..	*Noctuidae* ..	..	Achaea janata, L.

NICOTINIANA SPP. (TOBACCO).

Lepidoptera ..	*Noctuidae* ..	..	Prodenia litura, L.
			Cirphis unipuncta, Haw.
			Plusia signata, F.
	Gelechiidae	..	Phthorimaea heliopa, Low.
	Pyralidae ..	..	Peara hipponalis, Wlk.

THEOBROMA CACAO (COCOA).

Isoptera	*Termitidae*		Calotermes papua, Des.
Lepidoptera	*Noctuidae*		Tiracola plagiata, Wlk.
			Prodenia litura, L.
			Erias sp.
	Pyralidae		Ephestia cautella, Wlk. (in dried beans).
Coleoptera	*Curculionidae*		Pantorhytes plutus, Oberth.
			Orthorrhinus patruelis, Pasc.
			Platyachus ruralis, Fst.
	Rutelidae		Parastasia marmorata, Gestro.
			Parastasia inconstans, Frm.
	Eumolpidae		Rhyparida obscuripennis, Jac.
Rhyncota	*Flatidae*		Euphanta pokiana, Dist.
	Ricaniidae		Euricania splendens, F.

COFFEA SPP. (COFFEE)

Rhyncota	*Coccidae*		Mealy bug.
			Coccus viridis.
	Flatidae		Euphanta pokiana, Dist.
	Ricaniidae		Euricania splendens, F.
	Clacopidae		Clovia biarensis, Kirk.

GOSSYPIUM SPP. (COTTON).

Rhyncota	*Lygaeidae*		Oncopeltis dispar, Wlk.
	Pyrrhocoridae		Dysdercus cingulatus, F.
			Dysdercus sidae, Monk.

ERIODENDRON ANFRACTUOSUM (KAPOK).

Coleoptera	*Eumolpidae*		Rhyparida spp.
	Curculionidae		Platyachus ruralis, Fst.
	Luciolinae		Luciola sp.
Rhyncota	*Pyrrhocoridae*		Dysdercus sidae, Montr.

ORYZA SATIVA (RICE).

Lepidoptera	*Noctuidae*		Cirphis unipuncta, Haw.
	Pyralidae		Marasmia sp.
	Hesperidae		Parnara cinnara, Wall.
Coleoptera	*Curculionidae*		Platyachus sp.
			Exopthalmida rustica, Fst.
	Coccinellidae		Coccinella 8-maculata, F.
	Galleruchidae		Ceratia quadrimaculata, F.
Rhyncota	*Pentatomidae*		Nezara viridula, L. var smaragdula, F.
	Coreidae		Leptocorisa spp.
	Colobathristidae		Phaenacantha sp.

CROTALARIA SPP.

Lepidoptera	*Arctiidae*		Argina cribraris, Clk.
	Pyralidae		Etiella chrysoperella, Meyr.

ARTOCARPUS INCISA (BREAD FRUIT).

Diptera	*Trypetidae*		Dacus pectoralis, Walk.

		LEGUMINOSAE (BEANS, ETC.).	
Coleoptera ..	*Coccinellidae*	..	Epilachna doryca, Boisd. Epilachna signatipennis, Boisd.
Rhyncota ..	*Coreidae* ..	..	Riptortus sp. Noliphus erythrocephalus, St.
	Pentatomidae	..	Plautica fimbriata, F. Antestia semiviridis, Wlk.
		CITRUS.	
Rhyncota ..	*Coccidae* ..	..	Chionaspis simulatrix, Green.
		SOLANUM SP. (NATIVE).	
Coleoptera ..	*Coccinellidae*	..	Epilachna pustulata trincincta, Monk.
	Eumolpidae	..	Rhyparida lorquini, Baly. Rhyparida fasciata, Baly.
	Halticidae	..	Psylliodes sp.
		TIMBER.	
Coleoptera ..	*Bostrychidae*	..	Xylothrips religiosus, Boisd. Xylothrips capucinus, F. Heterobostrychus aequalis, Waterh.
	Buprestidae	..	Cyphogastra suturalis, F. Cyphogastra { granulata. granuloissima, Thery. Cyphogastra { gloriosa v. abdominalis, Wal ? Belionota fulgidicollis, Gestra. Iridotoenia auropennis, Kerr. Chrysobothris chrysonota, Deyr. Agrilus ? vittatus, Deyr. Chrysodema radians, Guer. Chrysodema smaragdula, Ol. Chrysodema sp. Chrysodema moluccaca, Deyr.
	Scolytidae ..	..	Xyleborus perforans, Woll. Xyleborus exiguus, Wlk. Xyleborus testaceus, Wlk. Xyleborus badius, Eichh. Nebbia canaliculatus, Egg.
	Platypidae ..	..	Platypus pallidus, Chap. Crossotarsus sp.
	Platypodidae	..	Platypus jansoni, Chap. Platypus forficula, Chap. Diapus pusillimus, Chap.
		STOCK.	
Diptera ..	*Muscidae* ..	..	Lyperosia exigua, de Mey.

COPRA DRYING.

By F. O. Moody.

The observations made in this article are based on practical experience of copra curing extending over a period of more than twenty years. It is not intended that they should form a technical paper, but serve merely as a practical guide to those engaged in the preparation of copra and as a solution of the many worries involved in turning out a good quality product.

There are three methods of drying copra, hot air, sun and open fires (smoke).

Hot Air Driers.

There are at present several types of hot air driers in use in this Territory. The old type kiln with one large drying table or a number of shallow trays (one above the other) heated from beneath by a system of flues, generally spoken of as the New Guinea drier; the Chula, in which the copra is dried in bulk in a large steel box and into which hot air is forced by means of a fan; the Windsor Stove, in which the heating is from a central stove, the hot air being carried from the stove by means of flues through the drying chamber; steam driers, in which the heat is derived from steam pipes from a boiler, the pipes running under and over the trays in the drying chamber; and the Ceylon type drier, in which open fires by means of coco-nut shells only distribute heat through nuts in the half shell on an open bed.

The type of drier in general use is the New Guinea drier, although of late the Ceylon type is becoming very popular, no doubt on account of the small cost of erection and the good results which can be obtained from this system of curing.

When erecting a new drier of any type, firstly, particular attention should be paid to position on account of weather and drainage, secondly, to ventilation, as where these two factors have been overlooked it is impossible to turn out first-class copra, and thirdly, a good weather-proof, well ventilated drying out and bagging shed is essential.

Copra.

First-class copra must be clean, white and brittle, in large pieces, preferably half nuts, with a moisture content of not more than five per cent., that is to say, when a piece of copra is broken it should show no sign of moisture. Copra of this class will not deteriorate to any material extent when stowed in well ventilated sheds for long periods.

Faults Generally Observed in Copra in this Territory and Probable Causes.

Sweating.

This may be due to several reasons. (1) No drying out shed, the copra being bagged too soon after taking out of drier. Copra should be left in the drying out shed for at least six days before bagging. (2) Underdried. (3) Copra cut in small pieces to hurry drying, taken out of drier when slightly undried and then bagged very tightly. (4) Copra drier situated on low lying ground with insufficient drainage, moisture rising from the ground under the flue pipes, or where there is a cement pit at the bottom of the drying chamber heavy rain causes water to get into the pit. The copra, instead of being dried, is steamed, and when bagged becomes hot and sweats the moisture out. The same condition arises when there

is insufficient ventilation, the hot air passing through the copra in the drying process collects the moisture, and if unable to get away settles back on the drying copra; or again, where there are a number of trays one above the other, the hot air as it passes through each tray collects the moisture until it reaches the top trays where we have the same result.

Burnt Copra.

This is largely due to (1) the fire end of the flue pipes too near the tray of copra (2) uneven ventilation where a portion may dry while the remainder becomes scorched and burnt, and (3) overloading of copra drier and big fires. The copra nearest the flue pipes becomes burnt and we get a mixture of burnt, casehardened, honeycombed and rubbery copra—the honeycombed copra later dries out, leaving a fibrous dust and rotten pieces.

Discoloured Copra.

Where green coco-nut meat has been kept too long before putting in the drier a bacterial fermentation sets up giving the meat a slimy appearance, and when the drying process starts this meat becomes discoloured and has a scorched appearance, or where there is more than one tray above the other and insufficient ventilation overhead, the moisture settles back on the top trays with the same result.

When coco-nut meat is cut it should be placed in the drier and drying process commenced as soon as possible. It does happen at times that coco-nut meat cut during the day is left in the bags or baskets till the evening of the next day, especially is this so where natives cut their own coco-nuts and may bring in more than the drier will hold at one filling.

Small Copra.

This fault is very prevalent, the idea being to ram as much copra into the bags as possible regardless of quality, in some cases bagging is between eleven and twelve bags to the ton. In order to do this a large percentage of the copra is broken to $\frac{1}{2}''$ pieces. Copra bagged at fifteen bags to the ton does not require heavy ramming and opens up in good condition.

Germinated Nuts.

Adverse reports have been received from London buyers regarding hot air dried copra containing a large percentage made from germinated nuts.

To improve the quality of hot air copra, germinated nuts should be dried separately and shipped as trade copra.

Ceylon Type Driers.

Copra from these driers is of fair quality, being well dried in half nuts, but at present a large percentage is either badly smoked or smoke stained. This may be caused by (1) too much draught through the coco-nut shells being forced to burn quickly, causing smoke, (2) shells not cleaned of all husk, or (3) damp shells.

To produce first-class hot air copra from the New Guinea Windsor stove or steam pipe type of drier the following is essential:—

(1) Correct ventilation.
(2) Coco-nut meat to be put in drier the day it is cut.
(3) Tray or trays not to be overloaded (one bag of green meat weighing approximately 140 lb. to a surface area of 6 x 8 ft.).

(4) Temperature of drier at commencement of drying process to be 110 degrees, rising slowly over a period of 10 hours to 130 degrees. This can be regulated by intake vents, the time taken to dry copra to a 5 per cent. moisture content will depend on the drier. Quick drying will not turn out good copra. After moving copra to drying out shed leave for at least six days with an occasional turn over before bagging.

Sun Dried Copra.

Weather conditions do not permit good sun drying throughout the Territory. The usual method of drying is to place the green coco-nut meat on movable trays in the sun, the trays being pushed into the drying shed at night or during rain. The period for drying is generally 5 to 6 days in good weather. Faults in sun drying are due to weather conditions, underdrying, or lack of supervision.

Smoke Dried Copra.

A large percentage of this class of copra is of very inferior quality, the idea appearing to be "anything will do for smoke copra", from half rotten sun dried copra which has been put through a process of smoke drying, to copra which has been burnt to a cinder in the hot air drier.

On a number of plantations the method of drying is to overload the drying table or tray and dry as quickly as possible, with the result that in one bag or consignment will be found anything from roasted copra to green coco-nut meat discoloured by smoke. Another method would appear to be to smoke cure the copra with little or no heat, with the result that copra arrives at the depots in an undried sweating condition.

Smoke copra can be well dried and of good quality, the same as any other class of copra, by not overloading the drying space, having small fires giving off heat (smoke is not necessary but cannot be avoided), giving the copra time to dry, then moving to drying out shed and allowing it to cool off and dry out for 5 or 6 days before bagging.

In conclusion I would state it is noticed on some plantations that hot air copra driers built years ago which were able to cope with the production at that time, are to-day patched up and although having lost a lot of their efficiency are still expected to cope with an increased production.

On a large number of plantations the tendency at present is to produce copra which will just pass inspection.

Owing largely to the planter himself and the copra inspection, the copra from this Territory has been improved and maintained at a higher standard, with the result that Rabaul copra is known on the European market and is at present quoted at over a pound per ton higher than South Sea, but with a little money spent on copra driers and sheds and a little more supervision and care, there is no reason why Rabaul copra should not top the market.

NOTES ON FLOWERING TREES IN THE BOTANIC GARDENS, RABAUL.

By L. E. Hanson.

The following notes comprise data on flowering trees only, but in subsequent issues it is proposed to publish notes on shrubs, creepers, &c.

These notes are based upon observations made in the Botanic Gardens, Rabaul, but it must be emphasized that the flowering periods are on a more or less sliding scale; seed is usually available approximately one month after the flowering.

Rabaul being in the tropical zone the seasonal changes are scarcely definable, being so slight as to be almost imperceptible. The heavy tropical rainfall has quite a different effect upon soil composition than in the more temperate zones where climatic conditions are conducive to strongly defined pollination periods.

The undermentioned trees are well worth planting, and, when at the flowering stage, will more than repay for the care and attention bestowed upon them.

When planting, care should be taken so that the trees selected will not dwarf the existing garden, otherwise the general design created may become unbalanced.

Alstonia scholaris (Apocynaceae).

A large tree of erect habit growing to a height of 100 ft. Small white flowers with strong perfume, which cover the foliage. Flowering period July to August. Propagation by seed.

Cassia bacillaris (Leguminosae).

The well known Cassia family contains some of the best flowering trees, *Cassia bacillaris* upholding the reputation. It grows to a height of 20 feet with yellow flowers, in pendulous racemes. Flowers almost continuously. Propagation by seed.

Cassia florida (Leguminosae).

This shapely tree grows to a height of 40 ft. with yellow flowers, and when in bloom makes a most attractive display. Flowers monthly. Propagation by seed.

Cassia fistula (Leguminosae).

Indian laburnum, growing to a height of 30 ft. with a profusion of bright yellow flowers. Blooms November, December, January and February. Propagation by seed, but seeds are very few.

Cassia grandis (Leguminosae).

South American species of Cassia with small pink flowers which completely cover the branches, and well worth planting. Flowers September, October and November. This tree grows to a height of 40 ft. and is propagated by seed.

Cassia multijuga (Leguminosae).

Fine feathery foliage and when in flower a most graceful tree with yellow flowers and growing to 30 ft. in height. Flowers September and October, but unfortunately has very few seeds for propagation.

Cassia nodosa (Leguminosae).

This tree is a magnificent sight when in full bloom with its pink and rose colouring. It grows to 40 ft. in height, flowers September, October and November, and is propagated by seed.

Cassia siamea (Leguminosae).

Used in Rabaul as an avenue tree. Flowers are plentiful and yellow in colour, grows to 50 ft. and blooms almost continuously. Propagation by seed.

Cassia sieberiana (Leguminosae).

Peach cassia. Undoubtedly one of the most beautiful of the flowering cassias, and when in bloom it is remarkably like a flowering peach. Grows to 40 ft. in height, the trees are deciduous and when new leaves form so does the bloom. Period of flowering October to January. Propagation by seed.

Couropita guianensis (Myrstaccae).

Cannon ball tree. A striking tree bearing its racemes of large white and pink fleshy flowers. The brown round fruits attain a diameter of 10 inches and are extremely heavy. It flowers almost continuously and grows to a height of 100 ft. Propagation by seed.

Cananga odorata (Anonaceae).

Known as Ilang-Ilang. The flowers are widely used by natives, strung on vines after the Hawaian "leis" effect. Worth growing for the sweetly scented flowers. Grows into a shapely tree 100 ft. in height. Flowers almost continuously. Propagated by seed.

Erythrina indica (Leguminosae).

Used as a shade tree on plantations. Grows to a height of 60 ft. and the bright red flowers are borne in clusters at the tips of the bare branches. Flowers October, November and December. Propagation by cuttings and seed.

Erythrina lithosperma (Leguminosae).

"Dadap." Tree of straggling growth with large bright red flowers—needs occasional pruning. Flowers October, November, December, and January, and grows 60-80 ft. in height. Propagation by seed and cuttings.

Eucalyptus naudiniana (Leguminosae).

Native name "Kamarare." Exceedingly quick growing tree with attractive foliage—grows 25 ft. in two years. Flowers are white and borne in clusters at tips of branches. Blooms December only. Propagation by seed.

Eugenia malaccensis (Myrtaceae).

Malay apple. Grows to 30–50 ft. Produces a profusion of crimson flowers, the bright red stamens of which, when fallen, create an effect of a scarlet carpet under the trees. Flowers February, March, April, August, September, and October. Propagation by seed and marcots.

Gliricidia maculata (Leguminosae).

Known as mother of cocoa and used as shade on many plantations. Grows to a height of 40 ft. The pink-mauve flowers are attractive but the trees do not produce many. Flowers August and September. Propagation by seed and cuttings.

Kleinhovia hospita (Sterculiaceae).

A large spreading tree with heart shaped leaves and reddish pink flowers which almost smother the foliage. Grows to a height of 50 ft. and flowers almost continuously. Propagation by seed.

Lagerstroema flos reginae (Lythraceae).

Queen flower of India. One of the most showy trees in the tropics with mauve-pink flowers, and grows to a height of 40 ft. Flowers February, March and April. Propagation by seed.

Melia azedarach (Meliaceae).

The Persian lilac. Graceful foliage and small white scented flowers. Grows to a height of 60 ft., flowers every two months and is propagated by seed.

Monodora tenuifolia (Anonaceae).

Orchid flower tree. The flowers are mottled yellow and green on a brown background and strongly resemble orchids. Grows to a height of 25 ft. but rarely flowers.

Michelia champaca (Magnoliaceae).

A handsome tree which has been planted in Rabaul avenues with success. The flowers are yellow and profuse, but while blooming comparatively continuously are at their best about November. Tree grows to a height of 50 ft. and propagation is by seed.

Melaleuca leucadendron (Myrtaceae).

Ti tree of Australia. In the flowering period (August to December) the tree is covered with small white flowers and berries. It grows to a height of 20 ft. and is propagated by seed.

Peltophorum inerme (Leguminosae).

Quick growing tree of spreading habit with striking flower spikes of yellow flowers and brown berries. A splendid tree and suitable for shade in gardens—when in bloom presents a beautiful picture. Flowers every two months and is propagated by seed.

Poinciana regia (Leguminosae).

"Flame of the forest." Also known as "Flamboyante." One of the finest flowering trees of the tropics. Tree grows to a height of 50 ft. and has large bright red flowers. Blooms November to December and is propagated by seed and cuttings. Under some soil conditions the life of this tree is comparatively limited owing to root-fungus disease.

Pongamia glabra (Leguminosae).

Indian beech. Well shaped tree growing to a height of 30 ft. with small white flowers. Flowers November to January.

Solanum maeranthum (Solanaceae).

Potato tree. Fruit shaped like a potato. Blue flowers two inches in diameter. Frequently flowers and grows to a height of 40 ft. Propagation by seed.

Soraca indica (Leguminoseae).

Asoha tree of India. A small spreading tree growing to a height of 30 ft. bearing on the stems and branches large clusters of scented flowers which change from yellow to orange. Seeds very rarely.

Spathodea campanulata (Bignoniaceae).

West African tulip. Flowers are bright red and large, covering the tree when in bloom. Grows to a height of 100 ft. and flowers almost continuously.

Propagation by seed. Although very decorative this species should not be planted close to buildings, owing to the brittle nature of the wood under high winds.

Spathodea nilotiea (Bignonaceae).

Smaller than *S. campanulata,* but well worth planting. Grows to a height of 70 ft. but does not flower frequently. Propagation by seed.

Amherstia nobilis.

The " peerless tree of the tropics " is often inquired for and although present in the Gardens, no data are as yet available on the flowering as the trees are still too young.

WARTS ON CATTLE.

By C. C. Marr.

Warts on cattle, particularly calves, are of common occurrence in the Territory. They are found on many parts of the body, but their location depends somewhat on the age of the animal.

In cows, warts usually occur on the udder or teats, and from these positions are spread to various parts of the head, neck and shoulders of suckling calves. These warty patches may spread from the original location to various parts of the body.

Cause of Warts.

It has been proved beyond doubt that warts in cattle are infectious, the infective constituent being a filterable virus. By experimental skin inoculation with warty material, growths have been produced in healthy cattle under one year of age. Under ordinary circumstances infection is thought to take place through injuries to the skin, when the injured part comes into contact with warty animals, fences, buildings, rubbing posts or any structure with which an infected animal has come in contact.

Prevention and Cure.

(1) Separate all warty animals from the herd.
(2) Clean and disinfect all rubbing posts, dip-yards, fences and camping grounds.
(3) Cows with warts on their teats or udder should be milked last, and the milkers should be careful to wash and disinfect their hands thoroughly after each milking, to prevent the possible spread of the virus from one animal to another.

In small herds of cattle, more particularly stud cattle, where individual attention is necessary, warts when first observed may be removed as follows without a great deal of trouble:—

If the wart at the place of attachment is small, either clipping with sterilized scissors or tying of a slender cord or sterile thread tightly round the base of the wart. In the latter case warts should slough off in a few days, after which the stumps of the warts should be touched with either glacial acetic acid, tinc. iodine, or silver nitrate. The layman should not attempt the removal of abnormally large warts, but should have them removed by a veterinary surgeon.

In this territory where periodical dipping for cattle tick is the common practice, it is very little trouble to inspect each animal closely as it goes through the race, and separate from the main herd any animals showing signs of wart infestation.

Thus, before warts become excessively large they may be removed by daily application of glacial acetic acid or tinc. iodine. When applying acetic acid be sure and grease all surrounding parts of the skin with vaseline or lard, &c., but be careful not to grease warts, as this would protect them also from the acid.

Small warts on the teats and udders of cows will often disappear if kept soft by daily application of castor oil.

If the presence of warts on an animal is so extensive as to render the above methods impracticable, it would be advisable to kill off badly affected animals, when the meat could be used for rationing labour. But if this is done, care should be taken to destroy by fire all warty infected skin surfaces.

Warts may occasionally disappear without treatment of any kind, especially as the animals become older. Most cases, however, require definite and systematic treatment.

Damage Done by Warts.

When warts become large and pendulous they are inclined to sap the strength of the cattle, and thus hinder the growth to a certain extent in young animals, but the main damage is observed in calf skins and cattle hides after tanning.

The tanned hides have roughened and weak spots where the warts occurred on the skin, and frequently contain numerous pits and holes in places, such as at the shoulders, where the wart infection is usually greatest. The parts affected are thus considered worthless, and if such skins are offered for sale on the market, drastic reductions are made.

Cattle buyers, also, in the world markets make discounts for warty animals purchased.

CONTROL OF RODENTS.

By John L. Froggatt, B.Sc.

The control of rats and mice is one that at times looms large, not only in dwelling houses but in storage barns and in the field, where by their depredations on agricultural crops serious losses often occur.

A considerable amount of study has therefore been devoted in many parts to their habits, &c., in order to evolve economic methods of control.

In dwelling houses and cellars, objection is mostly taken to poisoning as it often leads to the animals dying in inaccessible situations, as in the roof or under flooring, &c., resulting in much discomfort from objectionable smells.

Trapping does not lead to these troubles and is therefore more generally resorted to when rats and mice infest these situations. The guillotine trap operating a trip wire on a spring is the commonest, but the old wire cage with a trap door and removable end is not limited to a single catch and is a very suitable type for use in cellars and barns in particular.

In trapping in such localities it has been a long recognized fact that feeding the rats or mice for a few days in and around unset wire traps will draw numbers to that locality, and when the traps are set, the resultant catch leads to a much larger clean up of the pest than would otherwise be the case. Meal, chopped meat or other food can be led through the traps while open, thus accustoming the rodents to run through the cages.

In handling traps (or baits) care must be taken not to touch the wire, or baits, with the naked hands, as rats are very readily frightened by the smell left by human fingers.

In barns and sheds the rolling-drum barrel trap is very effective when properly constructed. The barrel is stood on end and has the top removed: a large round tin or other form of cylinder is suspended on a medium spindle across the open mouth of the barrel and smeared with fat, while the barrel is half filled with water. A piece of board is laid from the floor to the tip of the barrel and the rats going after the fat roll off the revolving drum into the barrel and are drowned.

For the protection of wheat and grain stacks in the open, excellent protection can be had by erecting a fence of galvanized iron buried to about 6 inches in the ground, with all posts inside the fence.

At intervals along this fence pits can be dug and either left open or old tanks fitted into them: the rodents working round the fence fall into the holes and very large numbers can thus be trapped and destroyed. In 1916-1917 when this method was adopted in the wheat areas of New South Wales for the protection of stacks at railway depots, even *tons* of mice per day were thus destroyed.

Fumigation has proved very effective in destroying rats in the field and where their burrows are met with under concrete floors.

Hydrocyanic (Prussic) acid is generally used: Calcium Cyanide is a chemical that evolves the poison gas relatively slowly and therefore has a decided advantage over the older methods in giving a safety margin to the operators: in practice the dust is blown into the burrows and the openings sealed.

For general field use poison baits of various kinds have proved very efficacious, and many proprietary preparations have been put on the market: formulæ for "home made" baits have been recommended in many of the publications of the U.S.A. Department of Agriculture and others.

Baits should be prepared and set out at such time as they will be fresh when the rodents come out in the early evening. Very often they will follow definite trails or tracks, and baits laid on these runways have the best chance of being eaten.

It is preferable to set the baits under covers, not only to protect them from domestic animals but also to imitate a natural shelter site for the rats and mice. An ordinary open drain pipe or galvanized iron down-piping can be used, or a piece of galvanized iron or a piece of old kerosene tin cut and bent into a curve and fastened to a piece of board, will also act as shelters, inside which the poison bait is placed and then set out.

The following formulæ are recognized as standard poison preparations for home use: there are, of course, many proprietary preparations, many of which at least contain one or other of the active ingredients mentioned below:—

A. Strychnine.

Mix $\frac{1}{8}$ oz. of powdered strychnine and $\frac{1}{8}$ oz. of baking soda together and dust over freshly-cut cubes (about $\frac{1}{2}$ in. dia.) of potatoes. This mixture is sufficient for about 2 quarts of potato cubes.

B. The Starch-coated grain bait.

Mix 1 tablespoon of laundry starch in $\frac{1}{4}$ cup of cold water: when this is an even smooth mixture, stir it into $\frac{3}{4}$ pint of boiling water to make a clean thin paste. Mix together 1 oz. of powdered strychnine and 1 oz. of baking soda and stir into the starch paste to form a smooth creamy mass free from lumps. Stir in $\frac{1}{4}$ pint of heavy syrup and 1 tablespoonful of glycerine.

Apply this mixture to 12 lbs. of wheat or crushed whole-oats and mix thoroughly to ensure that each grain is coated.

Strychnine, is, of course, a virulent poison and the greatest care must be taken in handling it. It is highly poisonous to all animals and humans. The reason for mixing baking soda with the poison in the baits is that the action of the poison is considerably hastened.

Barium Carbonate.—This chemical is only mildly poisonous and is therefore slow in action: it is odorles, tasteless and inexpensive.

This chemical is used with cereals or meal. The powder is thoroughly worked into the cereal or ground meal, either with the hands or with a spoon, in the proportions of 1 part of Barium Carbonate to 4 parts of the food. The mixture should be moistened to the consistency of a soft mush, as in this state it is far more readily eaten by rats and mice. One teaspoonful of the mixture is sufficient for one bait.

It can also be sifted over freshly sliced fruit or vegetables, and should afterwards be well rubbed into them. The ration of one part of powder to four parts of food should be maintained as far as practicable.

Red Squill.

Squill is a bulbous plant grown in the Mediterranean, there being two varieties, white and red, the latter having definite toxic properties against rodents, but comparatively harmless to humans, dogs, cats and other domestic animals.

As the percentage of toxic principles varies considerably, care should be taken to buy only standardized preparations of the powder, when the quantities recommended by the manufacturers will act as a guide to the quantities required.

In all cases of preparation of baits it is most important not to touch them with the hands more than is absolutely essential. Likewise it is also essential to wash the hands carefully after handling the baits.

METEOROLOGY.

Rainfall—Rabaul District.

Climatological conditions have a decided influence on the successful cultivation of many agricultural crops, as for example a dry season is required at blossoming time for the successful cultivation of mangoes and at harvesting time for kapok, coffee, maize, cacao, tea, &c.

Combined with a consideration of soil conditions, a sound knowledge of climatological factors will permit of defining areas in which certain crops are likely to be more successful than others, and where some crops are likely to be entirely unsatisfactory. Altitude will, of course, limit the successful cultivation of certain crops.

Such considerations are well recognized factors in the technicalities of tropical agriculture and should be carefully studied by all those proposing to launch into agricultural pursuits.

Much more and fuller data on meteorological questions have yet to be obtained for this Territory before its full application can be utilized for agriculture, and in this connexion valuable assistance can be rendered by non-official observers in different parts of the Territory, as has been done in some cases, by supplying rainfall figures and other data enabling us to correlate the various parts of the several districts.

It may be added that the Dutch East Indies have long recognized the value of accurate meteorological data, and as a result of their correlations have been enabled to indicate definite climatic zones in Java suited to particular crops.

From time to time it is proposed to publish in this *Gazette* meteorological information as to how it affects different parts of this Territory, and in this issue tables of the rainfall in the Rabaul District of New Britain appear.

The central recording station is at Rabaul, the capital of New Guinea, which is situated 4° 12′ south latitude by 152° 11′ east longitude in the well sheltered horseshoe-shaped Simpson Harbour. Rabaul is outside the cyclone and typhoon belt. Its mean temperature is 81.5° Fahrenheit, with a humidity by 9 a.m. readings of 76%. It has no cool season and rain falls throughout the year.

The altitude where the meteorological instruments and the rain gauge are kept in the Rabaul Botanic Gardens is approximately 40 ft. above sea level.

The rainfall in the Rabaul District is comparatively low compared with other parts of the Territory, and would no doubt be less were it not for the presence of the surrounding hills such as Mt. Mother (Kabiu) 2,247 ft., North Daughter (Balanataman) 1,768 ft., South Daughter (Turanguna) 1,621 ft., and Mt. Varzin (Vunakokor) 1,985 ft.

This district has two clearly defined seasons, the north-west monsoons from December to April, known as the wet season, and the dry season, May to November, when the south-east trade winds prevail and conditions occasionally approaching a drought are experienced as existed in 1914, when the Australian troops took possession, and in 1917 and 1931.

In the township of Rabaul well-water is available to augment the natural rain supply during any dry periods, but this well-water obtained from seepage is not suitable for drinking purposes unless sterilized.

At present tank storage water collected from the roofs of buildings constitutes Rabaul's only supply of drinking water for household purposes, but for the gardens a successful means of watering is that of the sprinkler type operated by a Macsom pump, as used by the Rabaul Bowling Club, from a well.

PHASES OF THE MOON, 1936.

Rabaul.

Jan.	2—First Quarter ..	1.15 a.m.	July	5—Full Moon	3.34 a.m.
	9—Full Moon	4.15 a.m.		12—Last Quarter ..	2.28 a.m.
	17—Last Quarter ..	5.41 a.m.		19—New Moon	1.19 a.m.
	24—New Moon	5.18 p.m.		26—First Quarter ..	10.36 p.m.
	31—First Quarter ..	9.36 a.m.		12—Perigee	7.6 a.m.
	15—Apogee	9.48 a.m.		26—Apogee	1.6 a.m.
	27—Perigee	3.30 a.m.			
Feb.	7—Full Moon	9.19 p.m.	Aug.	3—Full Moon	1.47 p.m.
	16—Last Quarter ..	1.45 a.m.		10—Last Quarter ..	6.59 a.m.
	23—New Moon	4.42 a.m.		17—New Moon	1.21 p.m.
	29—First Quarter ..	7.28 p.m.		25—First Quarter ..	3.49 p.m.
	12—Apogee	4.6 a.m.		7—Perigee	1.48 a.m.
	24—Perigee	8.24 a.m.		22—Apogee	7.12 p.m.
Mar.	8—Full Moon	3.13 p.m.	Sept.	1—Full Moon	10.37 p.m.
	16—Last Quarter ..	6.35 p.m.		8—Last Quarter ..	1.14 p.m.
	23—New Moon	2.14 p.m.		16—New Moon	3.41 a.m.
	30—First Quarter ..	7.22 a.m.		24—First Quarter ..	8.12 a.m.
	10—Apogee	2.18 p.m.		3—Perigee	6.48 p.m.
	23—Perigee	7.24 a.m.		19—Apogee	10.42 p.m.
Apr.	7—Full Moon	8.46 a.m.	Oct.	1—Full Moon	7.1 a.m.
	15—Last Quarter ..	7.21 a.m.		7—Last Quarter ..	10.28 p.m.
	21—New Moon	10.32 p.m.		15—New Moon	8.20 p.m.
	28—First Quarter ..	9.16 p.m.		23—First Quarter ..	10.53 p.m.
	6—Apogee	3.36 p.m.		30—Full Moon	3.58 p.m.
	21—Perigee	6.12 a.m.		2—Perigee	1.12 a.m.
				16—Apogee	6.30 p.m.
				30—Perigee	12.36 p.m.
May	7—Full Moon	1.1 a.m.	Nov.	6—Last Quarter ..	11.28 a.m.
	14—Last Quarter ..	4.12 p.m.		14—New Moon	2.42 p.m.
	21—New Moon	6.34 a.m.		22—First Quarter ..	11.19 a.m.
	28—First Quarter ..	12.46 p.m.		29—Full Moon	2.12 a.m.
	3—Apogee	10.24 p.m.		12—Apogee	7.48 p.m.
	19—Perigee	12.36 p.m.		28—Perigee	12.42 a.m.
	31—Apogee	12.54 p.m.			
June	5—Full Moon	3.22 p.m.	Dec.	6—Last Quarter ..	4.20 a.m.
	12—Last Quarter ..	10.5 p.m.		14—New Moon	9.25 a.m.
	19—New Moon	3.14 p.m.		21—First Quarter ..	9.30 p.m.
	27—First Quarter ..	5.23 a.m.		28—Full Moon	2.0 p.m.
	16—Perigee	7.0 a.m.		10—Apogee	6.6 a.m.
	28—Apogee	6.36 a.m.		26—Perigee	6.36 a.m.

(Apogee—The point in the moon's orbit farthest from the earth.)
(Perigee—The point in the moon's orbit nearest the earth.)

ECLIPSES, 1936.

There will be four Eclipses during 1936, two of the Sun and two of the Moon.

I.—A total Eclipse of the Moon, January 9th; visible in the Indian Ocean, Australia, Polynesia and the western part of the Pacific Ocean. Magnitude of Eclipse, 1.022. (Moon's diameter, 1.0.)

II.—A total Eclipse of the Sun, June 19th; not visible in Australia.

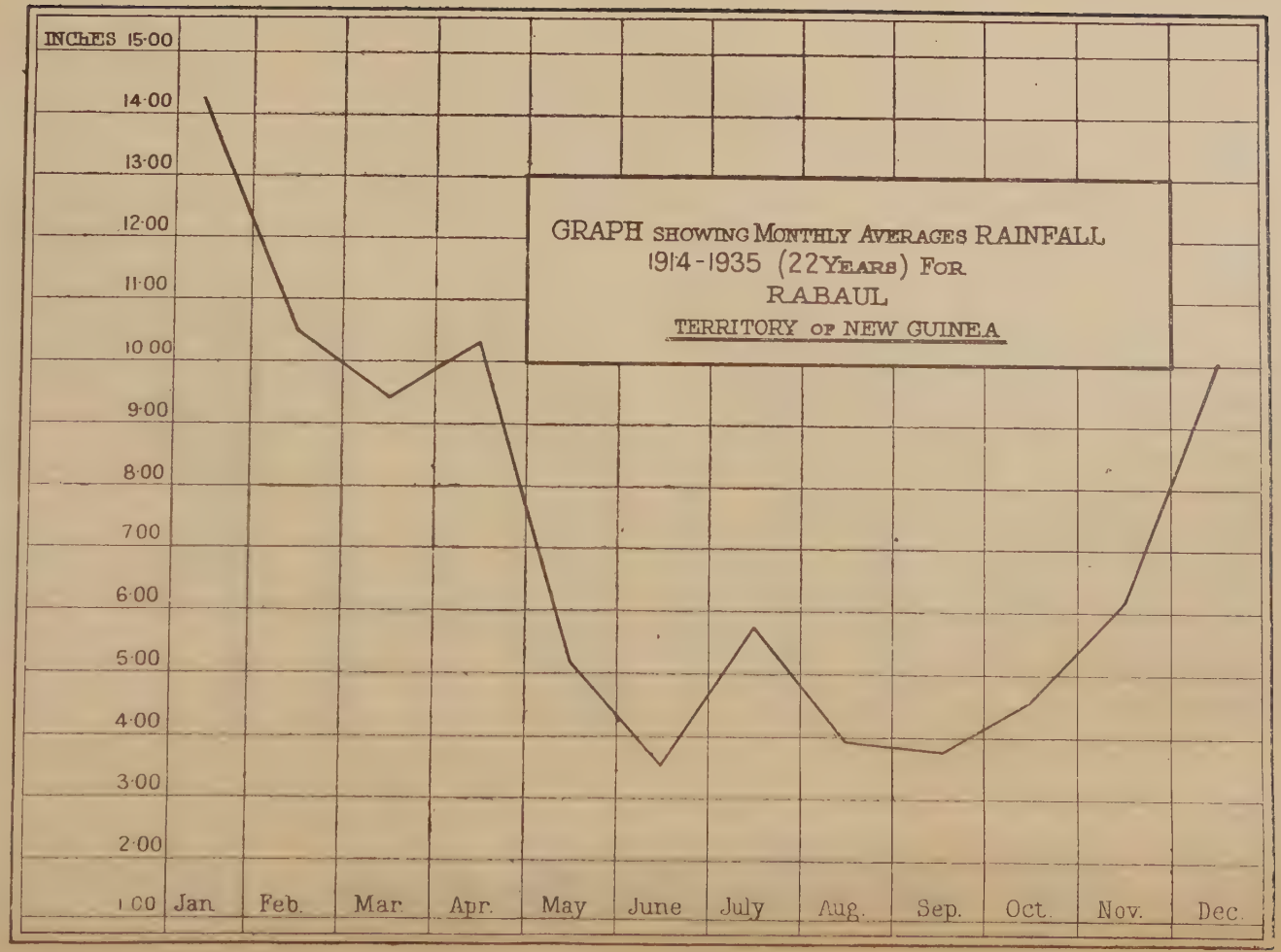
III.—A partial Eclipse of the Moon, July 5th; visible in the Indian Ocean, Australia and south-western parts of the Pacific Ocean. Magnitude of Eclipse, 0.272. (Moon's diameter, 1.0.)

IV.—An annular Eclipse of the Sun, December 14th; visible in Australia. The Eclipse begins at sunrise and will be visible in the eastern portion of Australia as a partial Eclipse only.

MONTHLY AND YEARLY RAINFALL TOTALS AT RABAUL.

(IN POINTS) STATION—BOTANIC GARDENS.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Total.
1914	1,168	1,281	805	485	356	79	9	103	32	62	226	866	5,472
1915	922	1,265	..	482	627	646	518	369	638	224	206	1,428	7,325
1916	3,774	789	607	445	342	150	126	217	648	481	705	952	9,236
1917	936	399	777	838	96	207	104	170	146	79	220	480	4,452
1918	477	1,017	1,128	269	576	657	940	344	95	221	686	993	7,403
1919	2,754	1,407	2,223	1,647	1,088	618	44	328	603	385	340	1,622	13,059
1920	478	1,046	391	1,253	1,081	461	537	625	502	739	650	1,566	9,329
1921	1,423	338	452	1,626	487	168	893	202	715	1,171	1,400	881	9,756
1922	1,109	964	871	1,173	316	224	930	604	362	143	1,002	1,000	8,698
1923	1,595	2,354	1,999	425	666	778	333	401	71	552	571	480	10,225
1924	2,336	1,184	611	454	104	246	370	36	543	295	946	713	7,838
1925	839	1,792	979	1,857	539	366	312	738	242	460	230	1,008	9,362
1926	1,374	643	1,389	1,137	780	424	1,221	738	417	485	721	736	10,065
1927	1,224	1,579	564	1,044	365	172	692	590	398	676	439	1,308	9,051
1928	970	465	465	1,001	513	222	495	589	465	1,186	311	568	7,250
1929	948	1,254	1,231	933	1,075	762	558	673	458	1,078	999	1,006	10,975
1930	846	896	939	901	1,127	114	1,800	301	88	88	285	1,612	8,997
1931	875	727	905	1,017	148	510	160	242	101	95	444	577	5,801
1932	1,867	1,978	552	1,613	74	266	837	208	280	649	796	1,322	10,442
1933	2,920	882	959	1,664	250	211	176	314	294	140	173	366	8,349
1934	838	395	857	913	592	346	386	327	688	507	792	1,477	8,118
1935	1,639	512	2,010	1,292	236	152	1,367	438	472	586	1,329	819	10,852
Average for 22 years ..	14.23	10.53	9.42	10.21	5.15	3.54	5.82	3.89	3.75	4.68	6.12	9.98	87.30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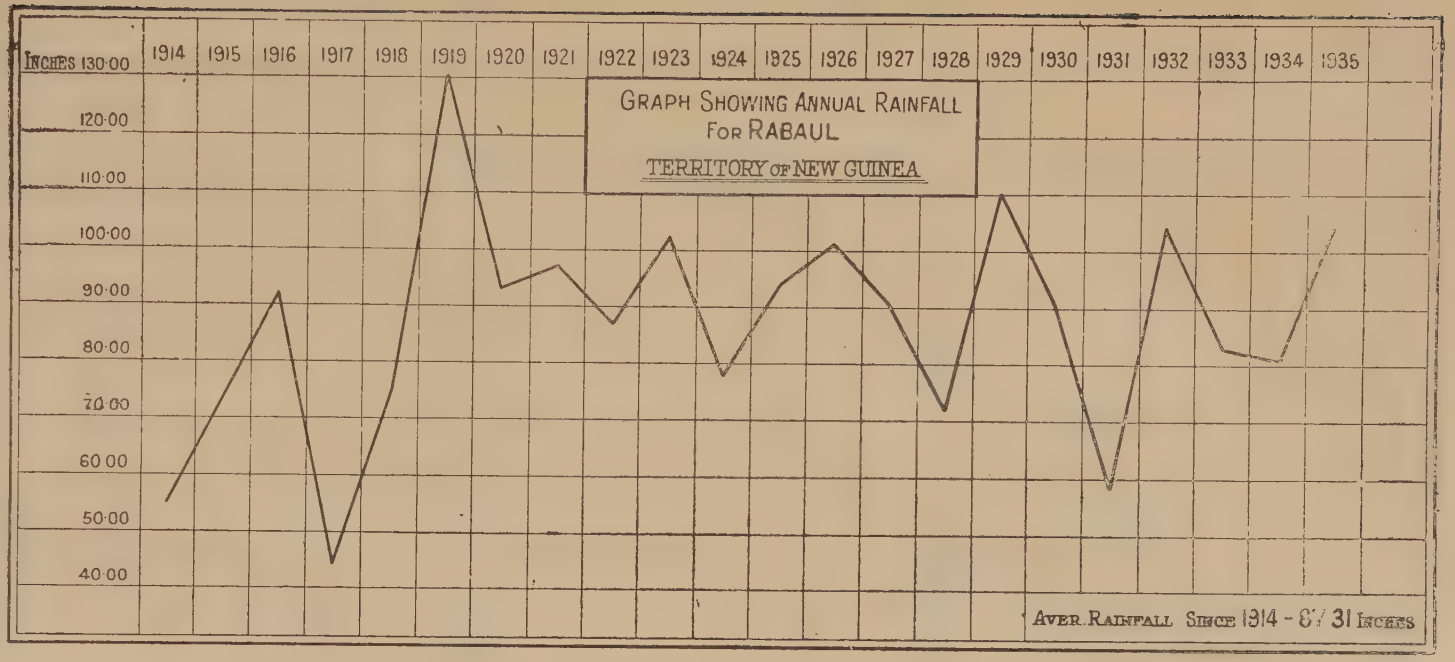
GRAPH SHOWING MONTHLY AVERAGES RAINFALL
1914-1935 (22 YEARS) FOR
RABAUL
TERRITORY OF NEW GUINEA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GRAPH SHOWING ANNUAL RAINFALL
FOR RABAUL
TERRITORY OF NEW GUINEA
AVER. RAINFALL SINCE 1914 - 87·31 INCHES

METEOROLOGICAL RECORDS.

Keravat Demonstration Plantation (North Coast, on Keravat River and Weberhafen).

Month.	1934.		Rainfalls.		Wet Days.	
	Rainfall.	Wet Days.	Period.	Average.	Period.	Average.
			Years.		Years.	
January	735	12	5	11.07	5	20.4
February	412	18	5	8.15	5	19.
March	413	15	5	7.71	5	19.4
April	931	20	5	12.52	5	22.2
May	796	23	5	6.83	5	20.8
June	742	19	5	6.28	5	17.8
July	1,044	30	5	7.51	5	20.
August	601	24	5	4.48	5	17.6
September	1,368	24	5	6.64	5	15.6
October	1,226	21	5	8.31	5	17.4
November	1,828	25	5	11.83	5	20.4
December	967	28	5	8.65	5	22.8

Average Annual Rainfall for 5 years, 1930 to 1934—99.99 inches. Rainfall for 1934—110.63 inches.

Kokopo (Government Sub-Station, South Coast).

Month.	1934.		Rainfalls.		Wet Days.	
	Rainfall.	Wet Days.	Period.	Average.	Period.	Average.
			Years.		Years.	
January	960	10	8	10.86	8	15.1
February	226	8	8	70.9	8	15.2
March	233	8	8	10.74	8	16.1
April	410	9	8	7.41	8	15.7
May	536	10	8	6.04	8	11.0
June	513	10	8	4.30	8	9.2
July	274	11	8	6.68	8	12.7
August	593	10	8	7.26	8	11.5
September	318	10	8	3.44	8	8.5
October	418	7	8	4.03	8	8.9
November	439	11	8	6.24	8	10.9
December	881	15	8	11.94	8	12.7

Average Annual Rainfall for 8 years, 1927 to 1934—86.03 inches. Rainfall for 1934—5,801 inches.

Rapopo Plantation (2 Miles East of Kokopo).

Month.	1934.		Rainfalls.		Wet Days.	
	Rainfall.	Wet Days.	Period.	Average.	Period.	Average.
			Years.		Years.	
January	1,178	10	2	13.21	2	12.5
February	416	9	2	5.34	2	7.5
March	583	10	2	6.54	2	9.0
April	788	11	2	8.20	2	13.0
May	581	12	2	4.34	2	8.0
June	563	11	2	5.10	2	9.0
July	461	17	2	2.84	2	11.0
August	914	11	2	8.47	2	10.5
September	660	12	2	4.46	2	8.5
October	485	8	2	2.74	2	5.5
November	600	14	2	3.62	2	9.5
December	1,157	12	2	8.27	2	11.5

Average Annual Rainfall for 2 years, 1933 to 1934—73.16 inches. Rainfall for 1934—83.86 inches.

TOBERA PLANTATION (ON HEIGHTS BEHIND KOKOPO).

Month.	1934.		Rainfalls.		Wet Days.	
	Rainfall.	Wet Days.	Period.	Average.	Period.	Average.
			Years.		Years.	
January	848	13	4	8.90	4	19.2
February	638	11	4	8.68	4	17.2
March	779	15	4	7.43	4	20.2
April	459	15	4	11.07	4	20.2
May	613	17	4	3.20	4	11.5
June	436	13	4	3.28	4	13.
July	502	22	4	7.18	4	15.
August	606	16	4	4.94	4	10.5
September	463	19	4	3.58	4	12.5
October	431	9	4	3.05	4	9.05
November	716	18	4	6.71	4	16.7
December	853	21	4	7.08	4	19.2

Average Annual Rainfall for 4 years, 1931 to 1934—75.14 inches.. Rainfall for 1934—73.44 inches.

WATNABARA, DUKE OF YORK ISLANDS (METHODIST MISSION STATION).

Month.	1934.		Rainfalls.		Wet Days.	
	Rainfall.	Wet Days.	Period.	Average.	Period.	Average.
			Years.		Years.	
January	535	9	11	12.41	11	21.
February	452	10	11	10.46	11	17.2
March	868	8	11	9.79	11	18.3
April	463	12	11	11.75	11	18.2
May	640	11	11	7.53	11	15.1
June	533	15	11	9.16	11	18.8
July	1,144	20	11	10.95	11	19.1
August	1,030	18	11	10.60	11	17.2
September	1,051	16	11	8.06	11	14.1
October	705	16	11	8.74	11	13.6
November	756	10	11	7.56	11	13.7
December	1,360	15	11	9.06	11	14.9

Average Annual Rainfall for 11 years, 1924 to 1934—116.06 inches. Rainfall for 1934—95.37 inches.

ENTOMOLOGICAL AND PLANT PATHOLOGICAL INQUIRIES.

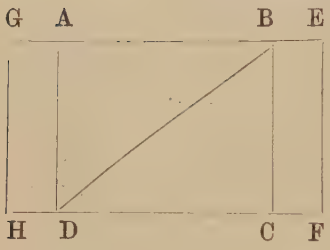
By John L. Froggatt, B.Sc.

Officers of the Department of Agriculture are always prepared to assist by giving such information and advice as is available on agricultural problems in reply to inquiries.

Although the man on the spot may fully understand the pest problems on his own particular area, if advice is to be given in reply to inquiries it is essential that not only specimens of the pests concerned and samples of the damage or the disease be forwarded, but also the fullest data on the outbreak must be given if a clear understanding of the position is to be gained by officers of the Department, from whom advice is sought.

For the guidance of inquirers the following notes are appended to ensure the arrival of specimens in good order and the supply of essential data:—

1. Specimens should not be sent in envelopes as they are liable to be so crushed as to be unidentifiable.
2. Soft-bodied insects should be sent in a small tube or bottle with methylated spirit, carefully packed in a small tin or box to prevent breakage.
3. Hard-bodied insects can be killed and dried and packed in a small box or tin with finely torn up paper and a little naphthalene added; or alternatively in a bottle with methylated spirits.
4. Ticks, mites, &c., are best sent in a bottle or tube of methylated spirits.
5. Butterflies and moths should be carefully killed and packed (wings folded) in paper triangles, which can then be packed flat in a box or tin with naphthalene for posting. These triangles are made as per appended diagram—



A folds to C

E–F folds over B–C

G–H „ „ A–D

6. If the insects are in the grub or caterpillar stage they should be packed in a *ventilated* box with sufficient of the plant on which they are feeding to carry to Rabaul so that on receipt there is reasonable chance to breed out the adults for identification. *On no account should they be packed in an airtight container.*
7. Insects in the chrysalis stage should be packed in a *ventilated* box with finely torn up paper.
8. Infested fruit or other material liable to fermentation, should be packed in a box with straw or dried grass. It must NOT be despatched in a sealed container, because, under such conditions fermentation will cause the destruction of all insect life present.
9. Large-bodied insects such as grasshoppers and large moths, should have the contents of the abdomen removed before despatch, otherwise destruction of the specimens by rotting will ensue.

10. With plant bugs it is essential that the adult (winged) forms should be included in any package submitted, as identification of the species from the immature (wingless) forms is, in most cases, impossible. It is, however, desirable that as many of the life cycle stages as possible should be included.
11. For killing insects, a cyanide bottle, prepared as follows, is the most satisfactory for general use:—

    Take any strong wide-necked bottle, place a little cyanide of potash in the bottom, and cover with a layer of plaster of paris, add sufficient water to just set the powder, and over this lay one or two thicknesses of blotting paper. The air in the bottle quickly becomes charged with hydro-cyanic (prussic) acid, and a few minutes in this atmosphere is generally sufficient to kill any insect placed in it.
12. As an alternative to the cyanide bottle, a few drops of chloroform will generally be quite effective.
13. It is always desirable when submitting specimens to also forward portions of the plant showing the damage caused by the insect.

Data relating to pest and disease occurrence should, as far as possible, include the following items:—

1. Crop attacked and area under such crop.
2. Symptoms—any variations from early to late infections.
3. Date infection started, or was first observed.
4. Degree of severity of attack.
5. Area affected, and whether this is localized or general throughout the area under cultivation.
6. Age of crop.
7. General state of the vigour of growth of the crop prior to attack.
8. Nature of soil and drainage on area infested.
9. Climatalogical data; rainfall; nature of the season, whether wet or dry as compared with the normal.
10. Nature of surroundings, e.g., is the area isolated in jungle or surrounded by other cultivations; if the latter to what extent, by what crops, and whether cultivated by Europeans or natives.
11. Conditions of cleanliness of crop attacked, and of any surrounding or adjacent cultivation.
12. What measures, if any, have been already undertaken to check the depredations of the pest.

If these suggestions are carried out as far as practicable in each case, the outcome of inquiries should be more satisfactory to all concerned.

Plant tissue affected by fungus diseases should be despatched as quickly as possible so as to prevent the development of secondary conditions that may so mask the original ones as to render identification extremely difficult, if not impossible.

If such transport is not possible, specimens, whenever the size is not too great, should be preserved in methylated spirits or 4% formalin.

Leaves and twigs should be pressed between sheets of paper so as to leave the specimens flat, and despatched in this manner.

By Authority: L. F. Johnston, Commonwealth Government Printer, Canberra.